

WASHINGTON

# SCIENCE TRENDS

HIGHLIGHTS

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## Saline Water Conversion

Research opportunities abound in the still new field of saline water conversion, according to a new U. S. Government report. Fundamental studies are held to be the answer to the problem of efficient, low-cost procedures. Here are some conclusions in a new study now available:

**\*Fundamental Research:** The Government believes it highly unlikely that any of the processes presently available for demonstration plants are the best that can be developed. Further research is required not only to improve these processes but to permit the achievement of a potential breakthrough. Exploratory research for new ideas, carried forward under contract with Applied Science Laboratories, Inc. includes studies and experiments on the use of ion retardation resins and on propane hydrate formation. Novel ideas have also been sought in such areas as radiation as a means of precipitating salt, use of fuel cells in conjunction with electrolysis, countercurrent processes using algae and the use of liquid inorganic material to extract salt. It is believed that a major lowering in demineralization costs might be achieved with a process that removes the salts (3.5 parts) rather than the water (96.5 parts).

**\*Process Development:** This phase of the Saline Water Conversion Program is concerned with development of various devices, systems, materials and processes; translating research data and investigations into working units or pilot plants. It is expected that no one process will ever provide the complete answer for all uses. Some may be preferable for sea water and some for brackish water. In addition, factors connected with location, such as fuel costs, weather conditions and waste disposal conditions must also be taken into account. Major processes under consideration and development include distillation using fuels, solar heat distillation, membrane processes, separation by freezing and a variety of chemical, physical or other conversion methods, including the use of gas hydrates.

**\*Demonstration Plants:** Congress, under prodding by legislators from states with water problems, has provided for construction of five demonstration plants, each to demonstrate a different process. It is hoped that with this program, for the first time, fresh water can be produced from the sea at a cost of about \$1 per thousand gallons -- a considerable achievement. However, laboratory investigations, still in progress, give promise of reducing this cost in half.

(Readers interested in obtaining details of the Saline Water Conversion Program may write for the latest Annual Report, available this week. Details of all major projects, publications and other information. 108 Pages. Single Copies Free. Write Director, Office of Saline Water, U. S. Department of the Interior, Washington 25, D. C. for 1959 Annual Report.)

### NASA Guidance-Control Programs

Here is a summary of current and near-future programs in the field of space guidance and control as planned by the National Aeronautics and Space Administration;

Current Programs stress advanced technical development of ---

- \* First Generation, or Phase I inertial guidance system utilizing analog techniques and guiding all phases of the launch booster.
- \* Phase II inertial guidance system utilizing digital techniques and possessing great flexibility in programming.
- \* Development of a completely digital precision autopilot for use in earth satellite missions which require supervision through burnout of the final boosted stage -- but which can be accomplished with less expensive control mechanisms.

Future Program, for the Fiscal Year which begins July 1, 1960, includes a start on so-called vehicle-contained capability for trajectory corrections. Terminal guidance and attitude control will be continued, in conjunction with the development of more sophisticated spacecraft to be carried on advanced boosters.

General goals include guidance and control equipment designed to provide the capability of circum-navigating a celestial body, establishing precise orbits, circularizing elliptical orbits at prescribed altitudes, controlling the approach and letdown for soft landings, and providing a means for the return of samples from the moon and reentry into the Earth's atmosphere -- either from escape velocity or from a satellite orbit. It is expected that this will be accomplished through the evolutionary development of vehicle-carried systems. At the same time, there will be a parallel program of component development for controls and sensors.

#### Program expenditures for Fiscal Year 1961:

Injection Guidance System Development .....	\$ 1,800,000
Midcourse Guidance System Development .....	\$ 1,300,000
Terminal Guidance System Development .....	\$ 250,000
Attitude Control System Development .....	\$ 200,000
Guidance Control for Centaur Spacecraft .....	\$13,000,000
Guidance Control for Saturn Spacecraft .....	\$ 1,650,000

#### Industrial Program -- Nuclear Technology

Atomic Energy Commission and the University of California at Berkeley will sponsor one, two and four-week courses this summer on radioisotopes and radiation technology. The programs were made possible by the first equipment assistance grant awarded under the Commission's Isotopes Development program.

(Management and technical personnel may obtain application blanks and additional information without charge. Write Engineering and Sciences Extension, University of California, 2451 Bancroft Way, Berkeley 4, Calif.)

## Electron-Tube Furnace

Continuous processing of ceramic electron tubes is said to be practical with a new vacuum furnace developed for the Navy Bureau of Aeronautics. The basic design is expected to be applicable to a number of other processes.

- \* Basic Operation: The unit is designed for the evacuating and sealing of ceramic wafer electron tubes. The tube assembly is introduced into a vacuum and heated to a high temperature. This combination of heat and vacuum degasses the tube. Meanwhile, the high temperature brazes together the metallized surfaces of the ceramic wafers to make a hermetically sealed unit.
- \* Advantages: The assemblies are processed into completely sealed and ready-to-use units by evacuating, degassing and sealing in a single continuous operation. The vacuum furnace performs these operations with control of only temperature, degree of vacuum, and time of processing. In addition, the high temperature eliminates the need for "getters" -- thus simplifying tube design. The furnace has produced up to 200 assemblies per hour.

Vacuum Furnace is essentially an 11-foot vertical tube of heat-resisting alloy, surrounded by a heating unit and open to the atmosphere at both ends. A series of hollow cylindrical specimen carriers, each separated by a short piston, passes through this tube. The parts are introduced at the tube at atmospheric pressure. Once inside, they are evacuated through ports along the side of the tube and through holes in the carriers. After processing, the parts are removed from the lower end of the tube -- at atmospheric pressure and at reduced temperature.

Heating Element is simply resistance wire supported in the inner side of a grooved ceramic cylinder. Five heat-reflecting shields surround the heating unit. The inner two shields are of molybdenum while the outer three are of stainless steel.

Carriers are of alloy steel, two inches in diameter and about four inches long. The carriers contain a number of half-inch holes to permit gas escape. Pistons are flame-coated with tungsten carbide on their outside surfaces to prevent the bare metal surfaces from brazing together in the intense heat of the furnace.

- \* Other Applications may include the coating of lenses or resistors by vapor-plating and the production of vacuum condensers and switches. It is suggested that when the processed article must come out of the vacuum near room temperature the lower end of the furnace could be lengthened and water-cooled.

(Machine conceived and designed by C. P. Marsden, Electron Devices Laboratory, National Bureau of Standards, Washington 25, D. C. Furnace mechanical development and construction by Sanders Associates Inc., Nashua, New Hampshire)

## AEC Access Permits

Atomic Energy Commission is holding a series of briefings on its new regulations covering access to classified technical information for participants in the AEC's program for developing peaceful uses of atomic energy.

(Future meeting agendas and reservation forms available from Miss Jean Moffett, U.S. AEC, 376 Hudson Street, N. Y. 14, N. Y. for May 25, 1960 meeting; D. E. Primm, U. S. Atomic Energy Commission, 9800 South Cass Avenue, Argonne, Ill., June 22, 1960 meeting and R. W. Hughey, U. S. AEC, 518 17th St., Oakland 12, Calif., June 29, 1960 meeting)

## RESEARCH CHECKLIST

- ( ) Cemented Carbides: Studies at the Army's Watertown Arsenal indicate that the strength and hardness of carbide compacts can be improved by the substitution of nickel for part of the iron in the binder of tungsten carbides. The Army has been looking for binders of alloy systems which do not employ ~~cobalt~~, a highly strategic material. Although tungsten carbides with alloy binders were not as strong as straight cobalt-bonded tungsten carbide in ~~some~~ applications, it was found that they could be used where extreme hardness was particularly desired.

(Report of Feb. 1959 now available. 28 Pages. 75 Cents. Write OTS, U. S. Department of Commerce, Washington 25, D. C. for PB 161 122)

- ( ) Cyrogenic Transfer System: Transfer of liquified gases through flexible, non-insulated plastic lines is said to have a number of applications in the field of cyrogenic cooling. The exterior of the lines is said to remain frost free; capable of being handled with safety though the liquid inside is - 320 degrees F. In tests, liquid nitrogen has been transmitted over distances greater than 25 feet. The previous maximum, using conventional techniques, is said to be six feet.

(R&D by AiResearch Manufacturing Division, The Carrett Corp., Los Angeles, Calif.)

- ( ) Sunlight Communication System: The Air Force is developing an experimental system designed to collect sunlight, run it through a modulator and direct the resultant light wave in a controlled beam to a receiver for space communications. At the receiver, the wave will be put through a detector, transposed into an electrical impulse and amplified to a speaker. Either a digital (dot-dash) or a voice message could be sent, depending on the type of modulator used. It is hoped that a working model can be assembled by late 1960. Advantages are said to include unlimited power from the sun's rays, relative simplicity and higher reliability, possible lighter weight, virtual freedom from jamming, and avoidance of already overcrowded radio frequency bands.

(R&D Directed by K. W. Otten, Communication and Navigation Laboratory, Wright Air Development Division, Wright-Patterson Air Force Base, Ohio)

- ( ) Improved Permeameter: Navy has developed a new permeameter for measuring grain-oriented, and especially cube-textured, magnetic materials. The improved device is said to offer greater efficiency while eliminating much of the complex equipment generally required. The instrument is designed to measure d-c fields from 1 millioersted to about 10 oersteds.

(R&D by C. Q. Adams, Magnetic Materials Division, Applied Physics Dept., U. S. Naval Ordnance Laboratory, White Oak, Silver Spring, Md.)



- ( ) Organometallic Compounds: National Science Foundation is sponsoring a three year study of the chemistry of organometallic compounds containing both metals and carbon compounds. Studies will include the character of the bonds between metals and carbons and may, it is hoped, lead to the discovery of compounds to increase efficiency of burning processes, and reduce electrostatic charges in petroleum pumping.

(R & D by Prof. Donald J. Cram, Department of Chemistry, University of California, Los Angeles, Calif.)

- ( ) High-Temperature Transformer: U.S. Navy, Bureau of Ships, is sponsoring development of a transformer designed to operate at temperatures up to 1200 degrees F., about 800 degrees higher than conventional units. Glass fabric covered wire and mica layer insulation will be used. The contract has also included development of a bentonite clay compound which can resist temperatures up to 1000 degrees and can be made in sheets as thin as .0005 inch. This compound is mixed with inorganic fibers such as glass quartz, or asbestos, depending upon the extent of heat resistance required.

(R & D by Commercial Apparatus and Systems Division, Raytheon Co., Waltham 54, Mass.)

- ( ) Coyote-Hole Blasting: The U. S. Bureau of Mines has completed its study of so-called coyote-hole blasting in which major charges of explosives are placed in tunnels parallel to the operating face. Such blasts are usually followed by secondary blasting, after which the rock is crushed and screened to small sizes. In one operation studied, 20 tons of explosives were detonated in two simultaneous, but physically separate blasts. A quarter-million tons of rock was broken.

(Report Available. 20 cents. Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Bureau of Mines Information Circular No. 7913)

- ( ) Ceramic Bearings: Tests by the National Aeronautics and Space Administration indicate that a crystallized glass ceramic such as Pyroceram may be useful in bearings where an operating temperature above the limits of steel is the major design consideration and where application will be under low-load, short-duration conditions. Best test results were obtained when a paraffinic mineral oil was used as a lubricant.

(Report Available, Single Copies Free. Write National Aeronautics and Space Administration, 1520 H Street, N. W., Washington 25, D.C. ATTN: CODE BID. Ask for Technical Note D-259)

- ( ) Infrared "Spotting Round": Army is studying the feasibility of using a small arms projectile to carry an infrared agent and act as a so-called "spotting round." It is hoped that the round will become attached to a target and that the material or mechanism it carries will serve as a homing beacon for other projectiles or missiles. Tests with soft metallic materials and paints have not proved satisfactory.

(R & D by Laboratories, Watertown Arsenal, N. Y.)

## PUBLICATION CHECKLIST

- ( ) Biological Affects of Atomic Radiation, a series of generally optimistic studies dealing with such aspects as genetic, pathologic, and meteorological effects, agriculture and food supplies, disposal and dispersal of radioactive wastes and oceanography. A "must" for anyone interested in these fields. Single Copies Free. (Write Information Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C.)
- ( ) Oil-Shale Retort, a report describing experimental operation of a gas-combustion retort developed by the Government for extracting oil from oil shale. Includes test results, diagrams and tables. 73 Pages. Single Copies Free. (Write Publication-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa., for Report of Investigation No. 5545)
- ( ) Gravitation, another in a new series of Reports in Progress by the Space Science Board. This chapter deals with basic considerations, possible future developments and proposals for satellite research on gravitation. 21 Pages. \$1. (Write Printing and Publication Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C. for Science in Space, Chapter II, Gravitation)
- ( ) Batteries, a 1959 report for the U. S. Air Force, now available. Discusses in summary form performance characteristics, structure, power-weight ratios and power-volume ratios of chemical batteries, fuel cells and so-called nuclear batteries. Includes diagrams of principle types and components. 97 Pages. \$2.25. (Write OTS, U. S. Department of Commerce, Washington 25, D. C. for PB 161 262)
- ( ) Review of the Space Program, another in a series of transcripts of Congressional hearings dealing with U. S. space research and military missile matters. Includes testimony by Army, Navy and National Aeronautics and Space Administration Officials. 835 Pages. Single Copies Free. Write Committee on Science and Astronautics, U. S. House of Representatives, George Washington Inn, Washington 25, D. C. for Review of the Space Program, Part 2)
- ( ) International Conference on Scientific Information, the Proceedings of a 1958 conference on ways and means of speeding and directing the flow of Scientific Information. Now available. Two Volumes. Price \$12 to conference registrants, \$20 to others. (Write Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C. for ICSI Proceedings)
- ( ) Depleted Uranium, a report by Battelle Memorial Institute for the Atomic Energy Commission on Potential Uses for Depleted Uranium including information on markets, potential hazards and related information. 58 Pages. 75 cents. (Write OTS, U. S. Department of Commerce, Washington 25, D. C. for TID-8203)
- ( ) Strength of Metal Aircraft Elements, a revised edition of a basic Defense Department handbook designed to provide uniform data on allowable stresses and other related properties of materials and structural elements for aircraft. With few exceptions, the information applies to requirements of the Navy, Air Force, Army and the Federal Aviation Agency. This publication is issued in looseleaf form but no binder is furnished. 251 Pages. \$2.50. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Pub. No. D 7.6/2:5)

